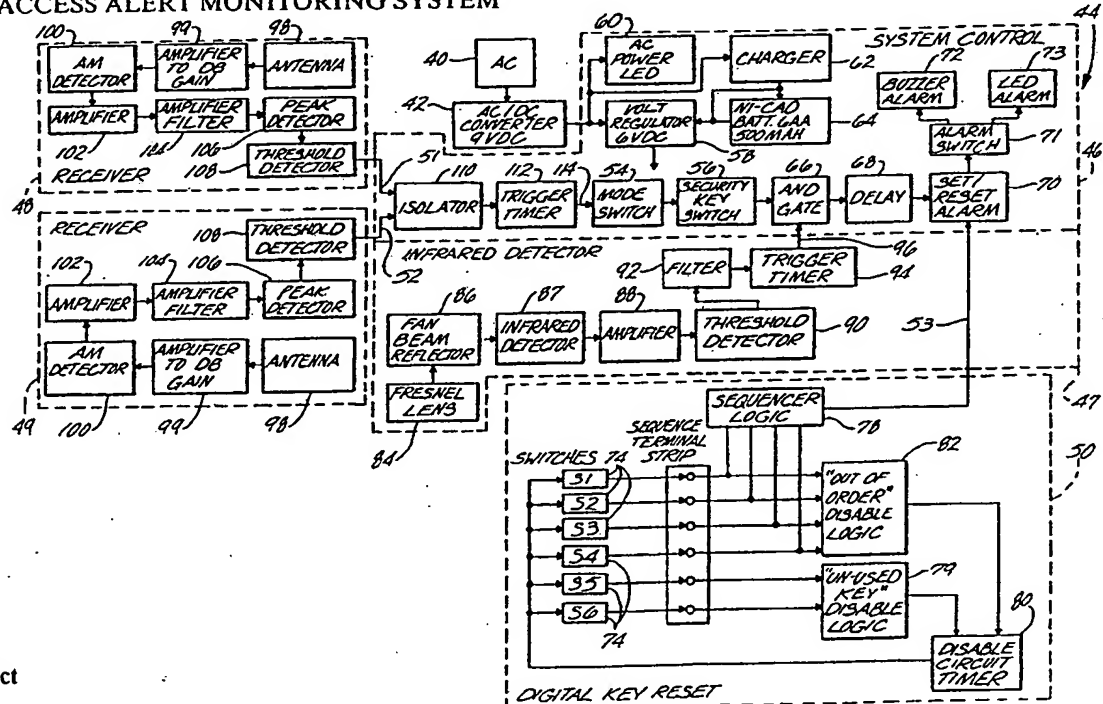


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 : G08B 23/00, 19/00		A1	(11) International Publication Number: WO 89/ 04031
			(43) International Publication Date: 5 May 1989 (05.05.89)
(21) International Application Number: PCT/US88/03721		(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent).	
(22) International Filing Date: 21 October 1988 (21.10.88)			
(31) Priority Application Number: 112,727			
(32) Priority Date: 23 October 1987 (23.10.87)			
(33) Priority Country: US		Published <i>With international search report.</i>	
(71) Applicant: F.B. NUTTER ENTERPRISES, INC., d.b.a. CORTREX ELECTRONICS, INC. [US/US]; 350 South Cypress Road, Pompano Beach, FL 33060 (US).			
(72) Inventor: SKATVOLD, Arthur, Ronald, Jr. ; 717 Per-dew, Ridgcrest, CA 93555 (US).			
(74) Agents: MAXWELL, Walter, G. et al.; Christie, Parker & Hale, 350 West Colorado Blvd., Suite 500, Pasade-na, CA 91109 (US).			

(54) Title: **ACCESS ALERT MONITORING SYSTEM**



(57) Abstract

A multi spectrum access control monitoring system with a low false alarm rate comprises a control unit (18) disposed above each guarded passageway in a controlled space. The control unit (18) includes a passive infrared detector (47) having a source of infrared energy to produce a narrow infrared fan beam (20) or "screen" across the passageway. The infrared screen (20) senses heat from the body of a person passing through the passageway, and an electrical control signal (96) is generated in response to passage of any person through the screen. Small portable RF transmitters (22) are carried by persons in a first group whose whereabouts are monitored. Persons in a second group to be monitored do not carry the transmitter units (22). The control unit (18) also includes an RF receiver (32) tuned to detect an identification signal generated by the portable transmitters (22).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	ML	Mali
AU	Australia	GA	Gabon	MR	Mauritania
BB	Barbados	GB	United Kingdom	MW	Malawi
BE	Belgium	HU	Hungary	NL	Netherlands
BG	Bulgaria	IT	Italy	NO	Norway
BJ	Benin	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	LI	Liechtenstein	SN	Senegal
CH	Switzerland	LK	Sri Lanka	SU	Soviet Union
CM	Cameroon	LU	Luxembourg	TD	Chad
DE	Germany, Federal Republic of	MC	Monaco	TG	Togo
DK	Denmark	MG	Madagascar	US	United States of America
FI	Finland				

1

5

-1-

10

ACCESS ALERT MONITORING SYSTEM

Field of the Invention

15 This invention relates to monitoring systems for detecting the movement of certain selected persons occupying a controlled space. The invention is particularly useful in institutions such as hospitals and convalescent homes for monitoring the whereabouts of patients or individuals with certain physical impairments. The invention is also useful in business
20 establishments such as offices for controlling security at certain restricted access locations within the building.

Background of the Invention

25 There is a need to control the access of people in certain areas, for instance in hospitals to control the movements of patients, or in convalescent homes or mental institutions where the memory of individuals is impaired and it is necessary to deny access of these
30 individuals to certain outside uncontrolled areas. It is often desirable to restrict these individuals to a particular room in a facility. The purpose is to prevent putting themselves into possibly harmful situations.

35

-2-

1 In the past, various electronic monitoring or
security systems have been developed to provide limited
access control functions. Some of these systems are as
simple as an alarm system which alarms when a person
5 passes through a doorway or passageway. An example is a
monitoring system using magnetic tags attached to
various articles, such as in bookstores, libraries and
department stores where the tags are detected if the
articles are moved past a sensor. Such systems are well
10 known for reducing pilferage or shop-lifting.

Other monitoring systems may include an electronic
system composed of radio frequency (RF) or microwave
transmitter/receiver sensors, sonic/ultrasonic/low
frequency sensors, optical (passive or active)
15 laser/infrared/visible light sensors, or simple switch
mats.

In order to be more selective as to which person is
passing through a doorway or passageway, an identifying
sensor attached to a controlled individual can be
20 detected to identify that particular person's movement
within the controlled area. The following U.S. patents
disclose a variety of security systems for monitoring
the movement of certain individuals: 3,839,709-
Sugiura; 3,928,843 - Sprout et al.; 4,136,338-
25 Antenore; 4,195,286 - Galvin; 4,447,726 - Mudge et al.;
4,593,273 - Narcisse; and 4,598,275 - Ross et al.

An electronic monitoring system can have
RF/microwave transmitter/receiver sensors where the
transmitter or diode multiplier is attached to the
30 controlled individual; sonic/ultrasonic/low frequency
systems where the transmitter or resonant circuit is
attached to the controlled individual; or magnetic
sensors where a magnetic tag is attached to the
controlled individual. All of these systems require
35 fine tuning and have a false alarm rate. These types of

1 sensors are not sufficiently reliable for use in a
monitoring system for controlling movements of
individuals through guarded passageways or doorways in a
controlled facility. A false alarm can occur when an
5 individual with an attached sensor does not enter a
doorway or passageway but does come into close proximity
and causes an alarm or positive sensor detection. An
example of this could occur when the controlled
individual is walking down a hallway adjacent to where
10 electronic detectors are in operation.

Further, some monitoring systems consume
transmitter battery power which is greater than
desirable. The transmitter life is thus too short, and
in some cases disposable transmitters are used which
15 result in high operating costs.

Some prior art security systems also are confined
to specific modes of operation for alarming. It is
desirable for a monitoring system to be capable of
operating reliably in various modes of operation that
20 can be pre-set depending upon the particular security
need.

The present invention provides an access control
monitoring system having a low false alarm rate. In
addition, the system has a multi-mode operating function
25 which can meet changing and varied requirements for
monitoring the movements of select individuals or
providing total security within a controlled area. In
one embodiment, the invention can be a physical security
barrier to detect specially implanted sensors in
30 articles as well as providing a security system to
protect the passage of any person. In addition,
transmitter battery power consumption is reduced, and
the system can be implemented at a reasonably low cost.

-4-

1 Summary of the Invention

 Briefly, this invention provides a multi-spectrum
access alert monitoring system for detecting and
identifying when a selected person from among a group of
5 persons has passed through a guarded passageway in a
controlled space. One embodiment of the system includes
an infrared detector for producing a narrow field of
infrared energy across the volume within the guarded
passageway. The detector produces an invisible energy
10 screen across the plane of the doorway or passageway so
that it is impossible to pass through without being
detected. A first control signal is produced in
response to detection of a person passing through the
detection screen. A portable transmitter unit for
15 generating an identification signal is carried by a
selected person or a selected group of persons whose
passage through the guarded passageway is to be
controlled. A different person or persons within a
second group of controlled individuals do not carry the
20 portable transmitter unit. A receiver is placed
adjacent the guarded passageway for detecting the
identification from the transmitter unit signal and
producing a second control signal when a person carrying
the transmitter unit is in proximity to the guarded
25 passageway. An access control unit associated with the
passageway processes the first and second control
signals to generate our alarm signal when a preselected
person whose movements are to be monitored passes the
guarded passageway. The control unit produces a first
30 indication of controlled passage through the guarded
passageway in response to simultaneous detection of the
first and second control signals, while producing a
second indication of control passage through the guarded
passageway in response to the first control signal being
35 generated by a person not carrying the transmitter unit.

1 In one embodiment, the persons whose whereabouts are to
be carefully controlled, such as patients in a hospital
or convalescent home, carry the transmitter unit,
whereas other personnel, such as staff workers, visitors
5 and vendors, do not carry the transmitter unit. In this
instance, the first indication of controlled passage
produces an alarm to indicate when the patient is
detected by the detector screen and the identification
signal from the transmitter is simultaneously detected
10 by the receiver. The second indication of controlled
passage is implemented by not producing an alarm signal
when other individuals having free access through the
guarded doorways and passageways are detected by the
detector screen. In an alternative mode of operation,
15 individuals having free access to doorways and
passageways can carry the transmitter unit and the
controlled individuals do not carry the transmitter. In
this instance, the alarm signal is generated when a
person not having the transmitter bypasses the detector
20 screen.

System reliability is enhanced by the multi-
spectrum combination of the infrared field at the
guarded passageway and the transmitter/receiver system
for discriminating between whether or not the person
25 passing through the infrared field is permitted in that
area or not. In addition, the mode of operation can be
easily preset so that the alarm signal is generated
either by persons carrying the identifying transmitter,
or by persons without the identifying transmitter
30 passing through the infrared field in the guarded
passageway. The system also can be adjusted to provided
a total security system to deny access to all persons
regardless of whether they carry an identifying
transmitter or not. Thus, in addition to providing a
35 highly reliable monitoring system essentially free of

-6-

1 false alarms, the system also can be adjusted to provide
various modes of operation so that the system can be
easily converted from one type of control to another
depending upon the security need.

5 These and other aspects of the invention will be
more fully understood by referring to the following
detailed description and the accompanying drawings.

10

15

20

25

30

35

1 Brief Description of the Drawings

FIG. 1 is a fragmentary semi-schematic perspective
view illustrating implementation of an access alert
monitoring system, according to principles of this
5 invention, in a hospital or convalescent home
environment.

FIG. 2 is a schematic view illustrating one
embodiment of the installation of components of the
access alert monitoring system at a doorway.

10 FIG. 3 is a functional block diagram illustrating
components of the primary access alert subassembly
components of the monitoring system.

FIG. 4 is a functional block diagram illustrating
components of a transmitter used in conjunction with the
15 system shown in FIG. 3.

20

25

30

35

-8-

1 Detailed Description

FIG. 1 schematically illustrates components of a multi-spectrum access alert monitoring system according to principles of this invention. FIG. 2 schematically illustrates implementation of system components adjacent a guarded passageway in a facility in which the monitoring system is used. Referring to FIG. 1, a hospital or convalescent home 10 has a wall 12 forming a portion of a hallway 14 which bypasses a guarded doorway 16. If a controlled individual passes through the doorway, an alarm is activated. Although the figure depicts use of the invention in a hospital or convalescent home facility, the invention also can be used in other buildings or offices within which access by different persons is monitored and controlled. Passage of persons through the doorway 16 is monitored by the access alert monitoring system of this invention which includes a control unit 18 mounted above the doorway. Details of the control unit are described in more detail below. Although the figure depicts use of the invention to control access of persons through the doorway, the invention also can be used to monitor and control movements of persons through any passageway such as the hallway 14.

25 The control unit 18 produces an invisible access detection screen 20 across the opening in the doorway 16.

30 The access detection screen is one of two types of sensors used in this invention to make a decision on whether a detected individual should activate the system alarm. The detection screen is produced by energy capable of detecting the presence of a person in the doorway. The screen has a very limited field of view and is preferably a narrow screen that occupies the volume within the doorway so that it is impossible for a

35

1 person passing through the doorway to be detected by the
detection screen. In a preferred embodiment, the
detection screen is produced by a narrow fan beam of
infrared energy.

5 The infrared screen is preferably produced by a
passive infrared detector with a window or filter which
maximizes its effectiveness in detecting heat emitted
from the human body. A lens subsystem in the control
unit includes a Fresnel lens with two reflectors to
10 produce a converged pattern or region of infrared energy
similar to a fan beam. The fan beam is directed
downwardly from above the doorway, across the opening
through the doorway 16. The infrared field occupies a
narrow volume within the doorway in the sense that the
15 infrared screen is narrow in the plane perpendicular to
the opening in the doorway and is wider in the plane of
the doorway so as to cover a substantial portion of the
projected area within the doorway. The screen is
effective so that it will detect heat from the body of
20 any person passing through the doorway.

The monitoring system also includes a portable
control access transmitter unit to be carried by each of
a plurality of persons in a first group of individuals
whose movements within the controlled area are to be
25 monitored. Such a transmitter unit is not carried by
any of the individuals in a second group of persons
whose movements are to be monitored. A "controlled
individual" is any person within a group of persons
whose whereabouts are controlled by the monitoring
30 system so that they are denied access or passage through
a guarded doorway or passageway. The controlled
individuals may be in the first group (those who carry
the transmitter unit) or, alternately, in the second
group (those who do not carry the transmitter unit). In
35 the embodiment illustrated in FIG. 1, the transmitter

-10-

1 unit 22 is carried by a nurse in the facility who has
free access to all open spaces within the facility
linked by the passageways or doorways guarded by the
access alert monitoring system. In this instance, a
5 patient 24 confined to a hospital room or the like would
not carry the transmitter unit 22 and the alarm would be
activated only if the patient passed through the guarded
doorway 16. This mode of operation of the monitoring
control system is illustrated in FIG. 1 as an example
10 only inasmuch as other modes of operation are possible,
and will be described in more detail below. The system
shown in FIG. 1 also may include a remote monitoring
station 26 having a remote alarm 28 activated when the
control unit alarm 30 is activated by passage of a
15 controlled individual whose whereabouts are being
monitored.

FIG. 2 schematically illustrates further components
of the access alert monitoring system. In this
embodiment, the control unit 18 is shown mounted above
20 the doorway with the audio or visual alarm 30 to be
activated by passage of a controlled individual. The
control unit also has an infrared energy source 32 which
produces the invisible infrared access detection screen
20. A pair of receivers 32 are positioned adjacent
25 opposite sides of the doorway 16 for receiving any
identification signal transmitted by the transmitter
units. The receivers and transmitters are operated on a
different energy spectrum from the access detection
screen. In a preferred embodiment, the receivers are
30 radio frequency (RF) receivers to receive a low range RF
signal from the transmitter units. The receivers are
positioned adjacent to doorway so that they will most
effectively receive RF signals transmitted by the
transmitter unit 22 from persons carrying the
35 transmitter units. Each receiver is connected to an

1 electronic control system in the control unit through
separate conductors 34 leading from the receiver to the
control unit. A digital reset lock 36 positioned
adjacent the passageway is connected to the control
5 system in the control unit. A set of switch pads 38 on
the reset lock are activated to produce coded input
signals for resetting the control unit after the alarm
has been activated, to place the control unit back in
its ready mode of operation.

10 In order to better understand the operation of the
access alert monitoring system from the description to
follow, the system will first be described generally in
relation to the various modes of operation provided by
the system. The system has a low false-alarm rate and
15 therefore high operating reliability owing to the access
control system operating from a multi-spectrum set of
input control signals, one produced by activation of the
invisible infrared access detection screen and the other
produced by detection of an RF signal from a transmitter
20 unit. This system determines whether there is anyone in
the doorway or passageway from detection by the infrared
screen and then determines whether the person detected
by the infrared screen has an attached RF sensor. Input
signals generated by these two diverse spectrum-related
25 functions are implemented in several modes of alarming
as follows:

(1) Admit Mode. This mode allows anybody without
an attached transmitter unit to pass or to be admitted
through a doorway or passageway without activating the
30 alarm. If a person has an attached transmitter, or if a
pilferable item is implanted with the transmitter, then
the system will alarm and thus deny access. As an
example, in a convalescent home environment, wandering
patients wearing a transmitter can be controlled by the
35 access control alarm, thus alerting the nurses and staff

-12-

1 of a denied access condition. The staff, visitors,
vendors, and the like, would have free access through
the doorways or passageways inasmuch as they would not
carry the transmitter unit.

5 (2) Reject Mode. This mode will activate the
alarm and thus deny or reject access to any person
without an attached transmitter who tries to pass
through the protected doorway or passageway. If a
person has an attached transmitter, then the system does
10 not alarm. In this mode, in a convalescent home
environment, only patients do not have an attached
transmitter and would be controlled by the system alarm
that alerts the nurses and staff of a denied access.
All other personnel, including all staff, visitors,
15 vendors, and the like would be required to carry an
attached transmitter in order to have free passage.

(3) Security Mode. This mode denies access
passage to all persons regardless of whether they have
an attached sensor or not. This mode is useful in
20 safeguarding doorways or passageways that lead to the
exterior of the facility. The alarm can be activated at
the discretion of the administrators or by an automatic
timer.

As a brief summary of the preferred access alert
25 monitoring system, the system first determines whether
anyone is in the doorway or passageway via detection by
the infrared access detection screen 20. If a person
passes through the infrared detection screen, a first
control signal is generated and sent to a system control
30 section of the controller to indicate passage of a
person through the doorway. The RF transmitter-receiver
system produces a second control signal sent to the
system control section of the controller to indicate
that the person passing through the infrared screen is
35 carrying the transmitter unit 22. Depending upon the

1 mode of operation, these two control signals can be used
to either activate the alarm (alert mode) or not
activate the alarm (reject mode). In a preferred
embodiment, the RF transmitter produces a low range
5 pulsed AM signal, preferably at a frequency of about 480
kHz. At this frequency, several advantages are
obtained. The propagation of this frequency is not
perturbed very much due to human body absorption. The
10 antenna is fabricated from ferrite rod devices that meet
the size constraint of an access control system. The
battery life (approximately six months of continuous
operation) of the transmitter is extended by using zinc-
air hearing aid batteries that are small and
inexpensive. The transmitter has very small components
15 and is amenable to small-size requirements of the access
control system. The RF transmitter-receiver link
operates at a low duty cycle 480 kHz signal with a pulse
repetition rate of approximately 700 Hz. This
transmitter consumes very low average power from the
20 transmitter battery and thus, contributes to long
battery lifetimes. The receiver is a direct detected
amplitude type with no local oscillator and thus does
not radiate or require FCC emission approval. A high Q
tuned circuit provides the selectivity along with a
25 bandpass filter following the amplitude detector. A
peak detector threshold is adjusted to determine the
receiver sensitivity. In one embodiment, the low power
output from the transmitter is received by the receiver
over a maximum range of about two feet.

30 As mentioned above, the system is installed with
the control unit above the doorway or passageway so that
the passive infrared beam is aimed downwardly toward the
floor. The logic and control electronics are contained
in the control unit. The two 480 kHz receivers mounted
35 on each side of the doorway are connected to the control

-14-

1 unit as described previously. The control unit is
powered by AC current with DC batteries as a back-up.
The transmitters are attached to the wrist or ankle or
waist by some means which does not allow the patient or
5 other user to remove it. If attached to staff
personnel, visitors or vendors, the transmitter can be
in the form of an identification badge. For
implementation into a pilferable item, a derivative of
either would suffice.

10 Although the alarm can be reset in various ways, it
is preferred that the reset function be carried out only
by staff personnel using a selected digital code
sequence input to the reset lock. Alternatively, an
automatic reset could be used after a set amount of time
15 after the alarm is activated.

FIG. 3 is a functional block diagram of the primary
components of the access alert monitoring system. This
assembly of components uses an alternating current (AC)
source 40 as a primary power source. An AC to direct
20 current (DC) converter 42 supplies 9 volts to a control
assembly 44 comprised of a system control section 46 and
an infrared detector section 47. Attached to the
control assembly are three sub-assemblies which include
two receiver sections 48 and 49 and a digital key reset
25 section 50. These sub-assemblies are attached via
cabling harnesses 51, 52 and 53. The system control
section 46 provides the decision logic on valid receiver
signals from the RF receiver section 48 and 49 and on a
simultaneously received valid signal from the infrared
30 detector section 53. The system control section also
allows for selection of two operating modes by the mode
switch 54, in which operation is selected in either the
admit mode or reject mode described above. The security
mode selection can be made by activating a security key

-15-

1 switch 56 which overrides the mode selected by the mode
switch to operate exclusively in the security mode.

5 The system control section 46 includes a voltage
regulator 58 to provide voltage regulation of about 5
volts for the entire assembly. An AC power indicator
light-emitting-diode (LED) 60 provides visual indication
of AC power on. A charging circuit 62 allows constant
trickle charging of six nicad batteries 64, so that
automatic power back-up is achieved through the voltage
10 regulator 58.

The alarm activation is controlled by an "AND" gate
66 and is then delayed by a delay timer 68 to minimize
false alarms before setting an alarm 70. When alarmed,
an alarm switch 71 activates an alarm buzzer 72 and an
15 LED alarm 73. The alarm continues until reset alarm 70
receives a valid signal from the digital key reset
section 50.

The digital key reset section allows for a sequence
of numerals to be entered by input switches 74 and coded
20 by a terminal strip 76, so that a four-digit code, when
properly entered, is decoded as a valid response by a
sequence logic circuit 78 and passed via the wiring
harness 53 to the alarm reset 70. If an unused key of
the switches 74 is entered at any time, a disable logic
25 circuit 79 signals a disable circuit timer 80 and all
the keys are disabled for about three seconds. If coded
keys are entered out of sequence, a disable logic
circuit 82 signals the disable circuit timer 80 which
again disables all of the keys for about three seconds.
30 The sequence code is set by wiring the terminal strip 76
in a desired sequence.

The infrared detector section 47 receives infrared
energy through a focusing lens, preferably a Fresnel
lens 84. A fan beam is produced by two reflectors 86
35 and the infrared energy is transformed to an electrical

-16-

1 signal by a pyroelectric detector 87 and then amplified
by an amplifier 88. A threshold detector 90 receives
the amplified output from the amplifier and passes it to
a filter 92 in order to minimize false alarms. The
5 output from the filter passes to a triggered timer 94,
which produces a control output signal 96 sent to the
AND gate 66. The control signal 96 from the infrared
detector represents a valid infrared detection signal
for the AND gate logic in the system control section.
10 When this control signal is generated, it indicates that
a person has entered the narrow fan beam of the infrared
detector and additional control steps within the system
control section are then carried out, depending upon the
selected mode.

15 The system includes two identical receiver sections
48 and 49. Each receiver receives a low-pulse
repetition frequency and low-duty cycle RF signal from a
transmitter described in FIG. 4. The RF energy enters a
tuned ferrite rod antenna 98, and then is amplified by
20 an amplifier 99, and then detected by an AM detector
100. The detected envelope is amplified by an amplifier
102 and then filtered by an amplifier filter 104 to
minimize false alarms. The signal from the filter is
then peak-detected at 106 and threshold-detected at 108
25 to set the signal sensitivity of the receiver to
preferably 480 kHz. Signals above the threshold are
directed via the wiring harnesses 51 and 52 to the
system control section. The sensitivity of the receiver
is low to minimize interference and yet be reliable for
30 short distances. For this reason, the two receivers are
mounted on each side of a doorway or passageway to be
monitored. A signal can be received by either or both
receivers, and these signals are isolated by an isolator
circuit 110 to prevent interference with each other. A
35 valid detected RF signal then activates a trigger/timer

-17-

1 112 to produce an output control signal 114 indicating
that the receiver section has validly received an RF
signal transmitted by the transmitter unit.

5 The mode switch 54 provides the logic of alarming
if a valid receiver signal and a valid infrared signal,
i.e., the signals 114 and 96, respectively, are received
simultaneously; or if no receiver signal and a valid
infrared signal occur simultaneously.

10 The security key switch 56 provides an override to
put the system in the security mode and produce an alarm
signal when a valid infrared signal occurs, regardless
of the receiver condition.

15 FIG. 4 illustrates the functional block diagram of
the transmitter unit 22. This transmitter is powered by
a single button battery 116, preferably a 1.4 volt
battery. To achieve low battery consumption, a low duty
cycle, low-pulse repetition frequency waveform is
generated by a capacitor charging circuit 118. This
turns on and off a one-transistor oscillator 120. The
20 RF frequency is determined by the antenna tuned circuit
122, which is a ferrite-type antenna.

25 Thus, the system provides a low false alarm rate
owing to the narrow infrared access detection screen
being used to detect passage of an individual through
the guarded passageway in combination with the RF
transmitter-receiver system and the associated control
logic which then detects whether or not the person
passing through the screen is authorized to gain access.
In addition, the alarm mode can be adjusted to meet
30 varied security requirements. Further, transmitter life
is extended and the cost of implementing the system is
reasonably low.

-18-

1 WHAT IS CLAIMED IS:

1. An access alert monitoring system for detecting and identifying when a selected person, from among a group of persons, has passed through a guarded passageway in a controlled space, the system comprising:

5 means for producing a narrow field of infrared energy across the width of the guarded passageway;

means for producing a first electrical control signal when the body of a person passing into said infrared energy field is detected;

10 a portable transmitter adapted to be carried by a selected person for emitting an identification signal;

receiver means adapted for mounting adjacent the passageway for detecting the identification signal and producing a second electrical control signal when the selected person is in a proximity to said guarded passageway; and

20 access control means responsive to detection of the first control signal and the second control signal for producing a first alarm condition when the infrared field and the receiver means simultaneously detect the selected person at the guarded passageway, said access control means producing a second alarm condition when the infrared field detects a person passing through the guarded passageway without said transmitter unit.

2. Apparatus according to claim 1 in which said first electrical control signal is produced in response to sensing infrared energy from the body of any person passing through the infrared energy field.

35

-19-

1 3. Apparatus according to claim 2 including an
infrared energy source adapted for positioning above the
passageway and focusing means for controlling energy
emitted from the infrared source to produce a narrow
5 screen of infrared energy across the volume within said
guarded passageway.

 4. Apparatus according to claim 1 including a
pair of receivers adapted from mounting on opposite
10 sides of the passageway, and isolation means for
detecting identification signals from either or both
receivers for producing said second electrical control
signal.

15 5. Apparatus according to claim 1 including mode
switch means for selectively adjusting operation of the
access control means to produce an alarm in response to
either the first alarm condition or the second alarm
condition.

20 6. Apparatus according to claim 5 including
security override means for producing the alarm only
upon sensing of a person within said infrared field.

25 7. Apparatus according to claim 1 including means
for providing a coded input signal to reset the access
control means after activation of the alarm signal.

30 8. Apparatus according to claim 1 in which the
transmitter unit and receiver means operate on radio
frequency within a selected frequency range.

35

-20-

1 9. Apparatus according to claim 8 in which the
transmitter and receiver have an operating frequency of
about 480 kHz and an operating range of about two feet
or less.

5

 10. A multi-mode access alert monitoring system
for detecting and identifying when a first group of
persons pass through a guarded passageway in a
controlled space and for detecting and identifying when
10 a second group of persons pass through the guarded
passageway; the system comprising:

 means for producing a narrow field of infrared
energy across the guarded passageway;

 means for producing a first control signal
15 when the body of a person passing into said infrared
energy field is detected;

 a portable transmitter unit for emitting an
identification signal;

 receiver means adapted for mounting adjacent
20 the guarded passageway for detecting the identification
signal and producing a second control signal when a
person carrying the receiver means is in close proximity
to the guarded passageway;

 access control means for receiving said first
25 and second control signals to produce an alarm signal
identifying a selected access condition depending upon a
selected preset access mode; and

 access mode switching means for presetting the
mode of operation of the access control means,
30 comprising (a) an admit mode for causing simultaneous
detection of the first and second control signals by the
access control means to produce said alarm signal to
activate an alarm to indicate that a person from said
first group carrying said transmitter unit has passed
35 through the guarded passageway, and in which said alarm

1 is inhibited when a selected person from the second
group sensed by the infrared field is not carrying said
transmitter unit; and (b) a reject mode for causing
5 simultaneous detection of the first and second control
signals by the access control means to inhibit
activation of the alarm when a person from the second
group carrying the transmitter unit passes through the
guarded passageway, and in which said alarm signal is
10 activated when a person from the first group sensed by
the infrared field is not carrying said transmitter
unit.

11. Apparatus according to claim 10 including
security override means to produce an alarm only upon
15 sensing of a person by the infrared field.

12. Apparatus according to claim 10 including an
infrared energy source adapted for positioning above the
passageway and means for focusing the energy admitted
20 from the infrared source to produce a narrow fan beam of
infrared energy across the area within the guarded
passageway.

13. Apparatus according to claim 10 including
25 means for producing a coded input signal to reset the
access control means after activation of the alarm
signal.

14. Apparatus according to claim 10 in which the
30 transmitter unit is portable and produces a radio
frequency signal within a frequency range of about 480
kHz.

-22-

1 15. An access alert monitoring system for
controlling the freedom of movement of persons in a
first group and persons in a second group to access
5 areas within a controlled space having a guarded
passageway between said access areas, the system
comprising:

a plurality of portable transmitter units
carried by persons in the first group for emitting a low
range identification signal; and

10 a control unit adapted from mounting adjacent
a selected passageway to be guarded, the control unit
including means for producing a narrow field of infrared
energy across the guarded passageway; means for
producing a first electrical control signal when the
15 body of a person passing into said infrared energy field
is detected; receiver means adapted for mounting
adjacent each of said guarded passageways for detecting
said identification signals from the transmitter units
and producing a second control signal when a person in
20 the first group is in proximity to the guarded
passageway; and access control means responsive to
simultaneous detection of said first and second control
signals for activating an alarm in said control unit to
indicate that a person in the first group has passed
25 through the guarded passageway, said access control
means inhibiting activation of said alarm signal when a
person in the second group not carrying of said
transmitter unit is detected by said infrared energy
field.

30

35

-23-

1 16. Apparatus according to claim 15 in which each
control unit further includes a mode selection means
comprising:

5 (a) an admit mode for causing simultaneous
detection of the first and second control signals by the
access control means to produce said alarm signal to
activate an alarm to indicate that a person from said
first group carrying said transmitter unit has passed
10 through the guarded passageway, and in which said alarm
is inhibited when a selected person from the second
group sensed by the infrared field is not carrying said
transmitter unit; and

15 (b) a reject mode for causing simultaneous
detection of the first and second control signals by the
access control means to inhibit activation of the alarm
when a person from the second group carrying the
transmitter unit passes through the guarded passageway,
and in which said alarm signal is activated when a
20 person from the first group sensed by the infrared field
is not carrying said transmitter unit.

17. Apparatus according to claim 16 including
reset means adjacent each guarded passageway for
providing a coded input signal to reset the access
25 control means after activation of the alarm signal.

18. A multi-spectrum method for controlling access
to areas within a controlled space having at least one
guarded passageway, comprising the steps of:

30 producing a narrow invisible detection screen
across the guarded passageway;

 detecting when the body of a person passes
into said detection screen and producing a first control
signal in response thereto;

35 providing a portable transmitter for

-24-

1 generating an identification signal, said transmitter to
be carried by a person whose passage through the guarded
passageway is to be controlled;

5 placing a receiver adjacent the guarded
passageway for detecting the identification signal and
producing a second control signal when a person carrying
the transmitter unit is in proximity to the guarded
passageway; and

10 providing an access control unit associated
with the passageway to produce a first indication of
controlled passage through the guarded passageway in
response to simultaneous detection of said first and
second control signals, while providing an alternate
15 second indication of controlled passage through the
guarded passageway in response to the first control
signal being generated by a person not carrying said
transmitter unit.

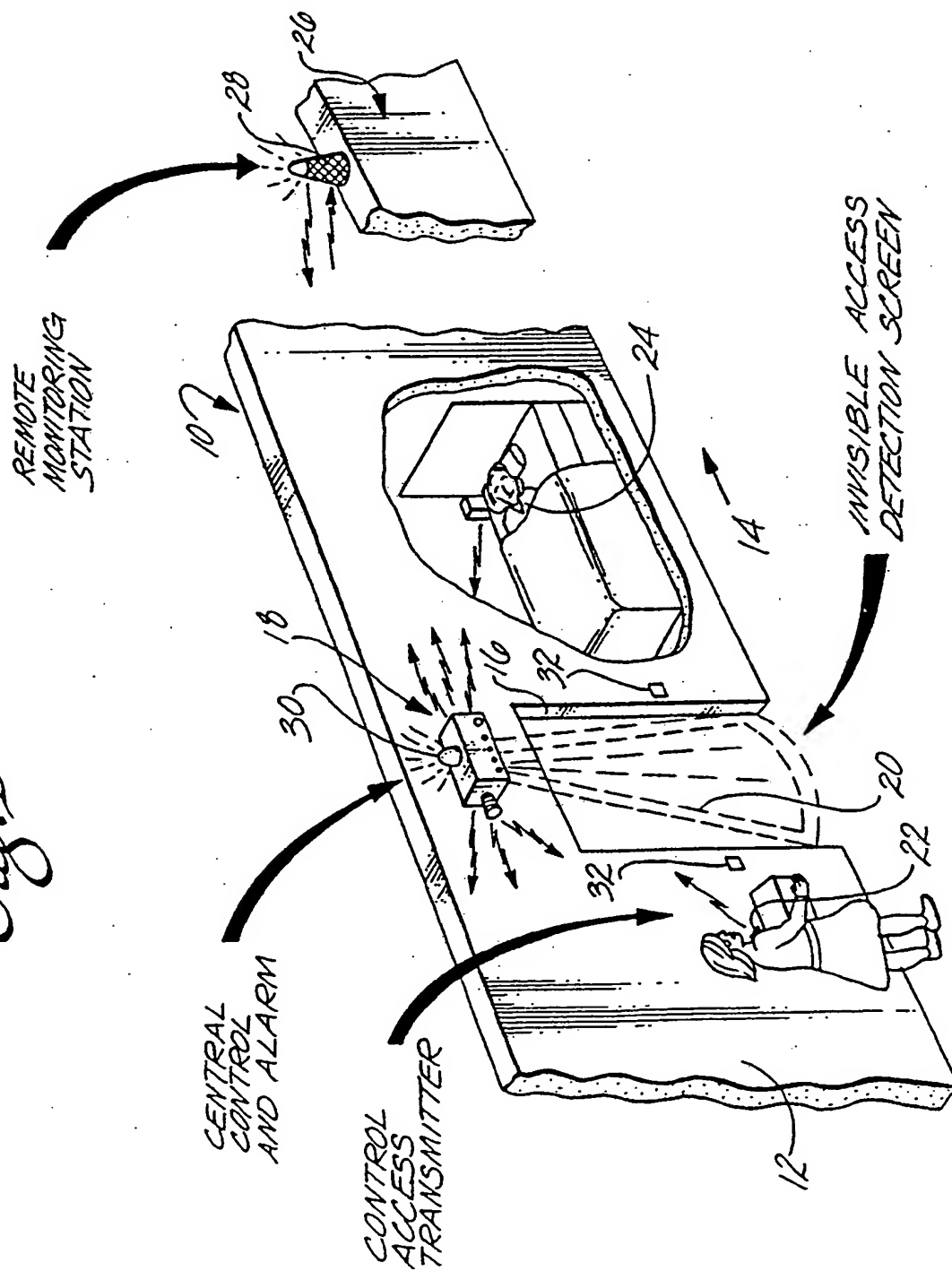
20

25

30

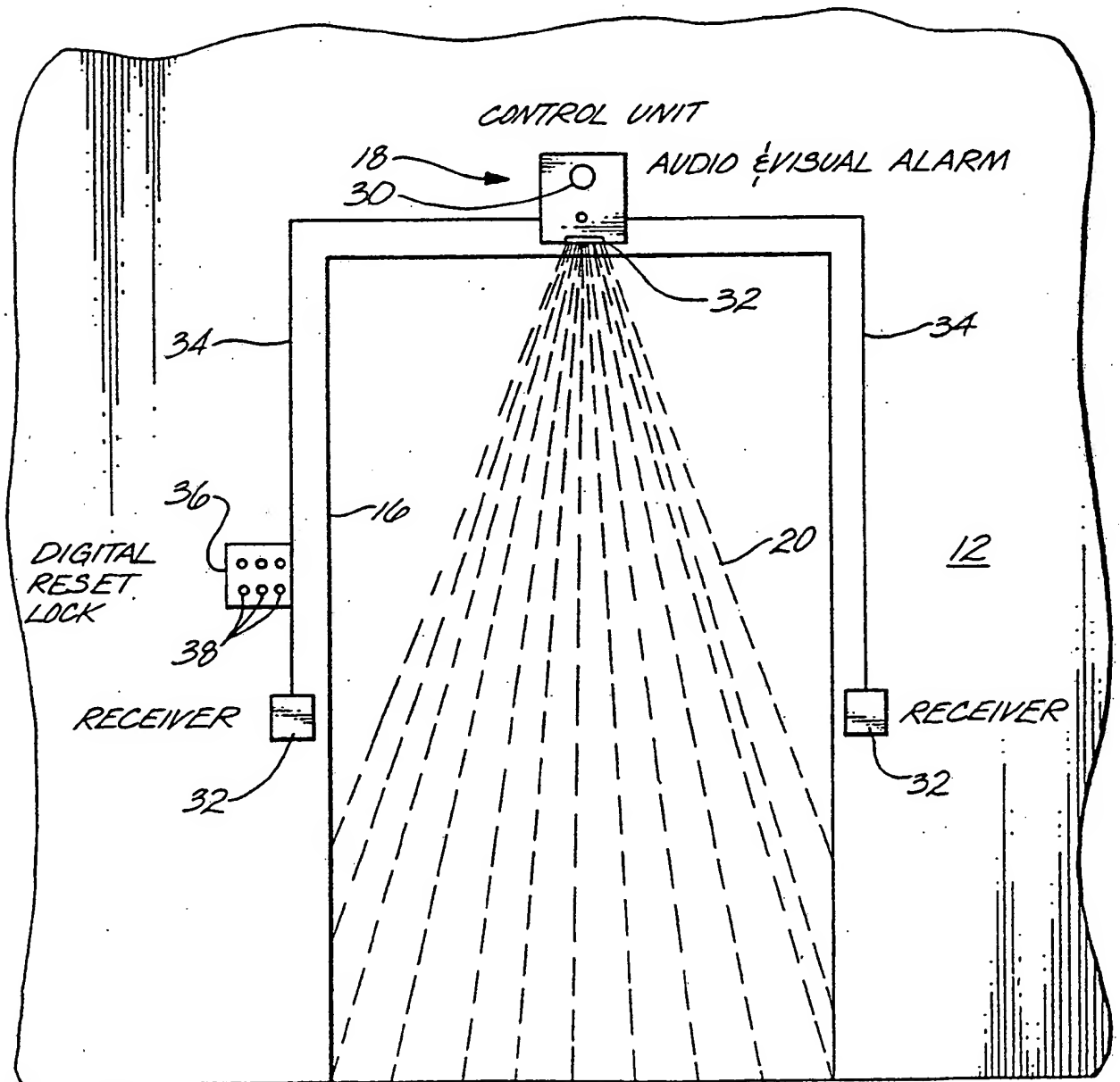
35

Fig. 1



2/4

Fig. 2



SUBSTITUTE SHEET

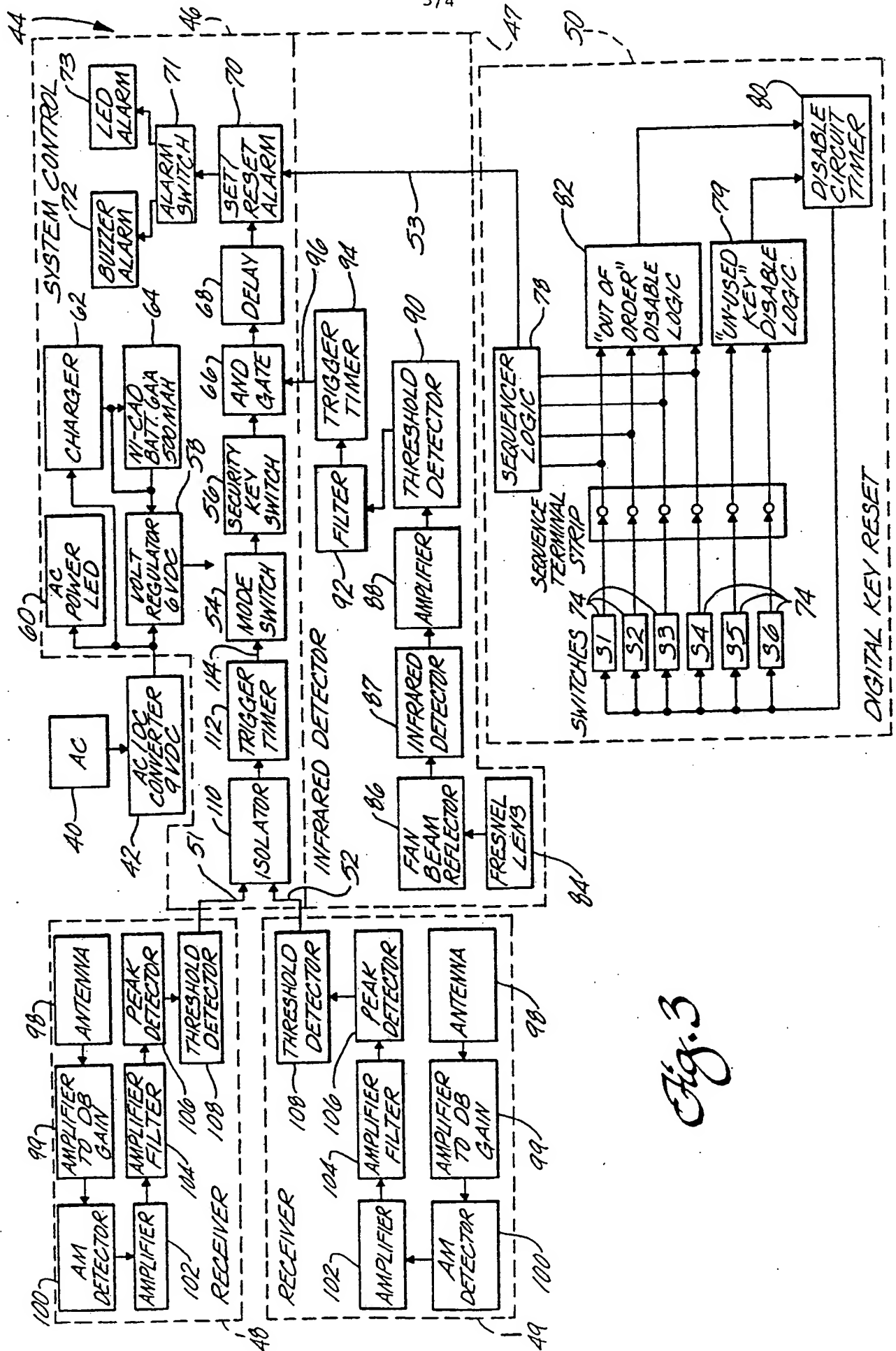
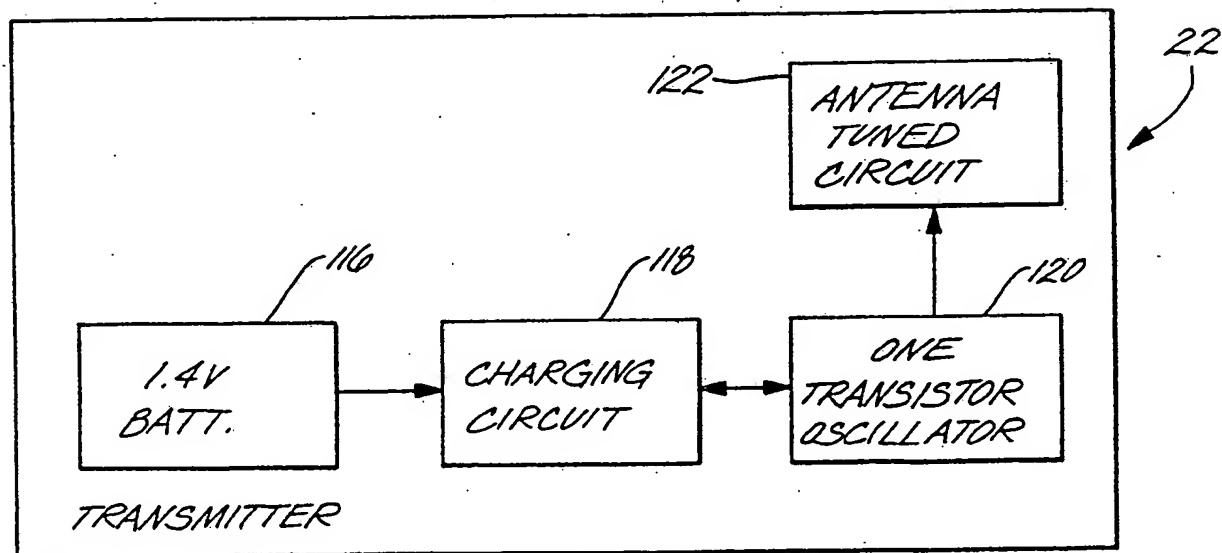


Fig. 3

Fig. 4



INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US88/03721

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4): G08B 23/D0, 19/00

U.S. CL. 340/573; 340/522

II. FIELDS SEARCHED

Minimum Documentation Searched ⁷

Classification System	Classification Symbols
U.S.	340/573, 572, 567, 545, 522; 455/100

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁸III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹

Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US, A, 4,684,933 (DILL) 04 AUGUST 1987 See column 2, line 59 to column 3, line 11.	1-4,7-9,15,18
Y	US, A, 4,682,155 (SHIRLEY) 21 JULY 1987 See column 3, lines 62-66 and column 4, lines 60-64.	1-4,7-9,15,18
Y	US, A, 4,660,024 (McMASTER) 21 APRIL 1987 See column 2, lines 34-45.	1-4,7-9,15
Y	US, A, 4,590,460 (ABBOTT ET AL.) 20 MAY 1986 See column 2, lines 44-52.	3

^{*} Special categories of cited documents: ¹⁰^{"A"} document defining the general state of the art which is not considered to be of particular relevance^{"E"} earlier document but published on or after the international filing date^{"L"} document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)^{"O"} document referring to an oral disclosure, use, exhibition or other means^{"P"} document published prior to the international filing date but later than the priority date claimed^{"T"} later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention^{"X"} document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step^{"Y"} document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.^{"&"} document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

13 DECEMBER 1988

International Searching Authority

ISA/US

Date of Mailing of this International Search Report

02 FEB 1989

Signature of Authorized Officer

Thomas J. Muller, Jr.